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versities are the chief means for the advancement of science and since the results would have direct relation to the work of instruction, a plan might be devised by which a number of universities would jointly provide for it.

In conclusion, if this be thought worthy of further discussion, let the motive of the writer's suggestion be clear. It is the advancement of science in America by means of organized reviewing of current literature as an aid in the development of the future investigator. This may be regarded by some as in the nature of 'coddling' which would lead into scientific work those who are unfit and who would not succeed. No one is less inclined than the writer to give undue encouragement to students. On the other hand it is an open question whether science is not now losing fit persons for want of some such introduction to the workshop. It is not desired that the literature should be brought down to the level of the average student. The reviews should be written for the serious man who is seeking his proper place and the opportunity to do work.

J. B. JOHNSTON.

NAPLES,

November 29, 1904.

THE ORIGIN OF CYCLONES, TORNADOES AND COLD WAVES.

TO THE EDITOR OF SCIENCE: As it seems still to be held that the origin of cyclones, tornadoes and cold waves is matter of debate I beg to offer a résumé of an article on that subject contributed some twenty years ago to the *Educational Courant* of Louisville, Ky., and which at the time received somewhat extensive notice.

The contention of that article was that cyclones arise exclusively over tropical islands. It is quite obvious that the movement of the atmosphere over every island that has a sea-breeze as well as above every local fire, must be cyclonic. The vast majority of such cyclonic movements disappear with the reversal of the breeze which occurs at night. But now and then, under particularly favoring conditions, it happens that over a tropical island the cyclonic movement gains such force as to enable it to ascend to a great altitude, and

this results in such concentration of vapor and consequent evolution of heat as to supply a new force for the continuation of the movement.

Now the trade winds on their equatorial border describe a loop, while passing from the southwesterly movement below to the northeasterly above, in such way that the wind in those situations may be very swift at considerable altitudes over regions of calm below.

Say one of the daily cyclones described arises over one of the Cape Verde Islands off the coast of Africa, or over one of the Windward islands, and let the conditions be such that when the cyclonic movement attains a considerable height it is caught in the loop of the trade winds moving to the westward. It will be carried to the west along the southern border of the loop, the strength of the southerly flow of the trade winds being sufficient to prevent the upper return or northerly flow from carrying it to the north. But in the course of its journey it enters a region where friction due to the continental mainland has largely interfered with the trade winds, and which interference has resulted in a weak movement of the trade winds of the surface as compared with the return winds above—this retardation after the cyclone has turned and begun its journey to the eastward. There must then be some close connection between them; a connection that would suggest the relation of cause and effect. But how can the low produce the high and its resulting cold wave. If we take into consideration the three facts that the cyclone itself is moving eastward at the rate of 20 or more miles an hour; that at the same time it is revolving contra-clockwise so that its northern segment has a potential westward movement of thirty or forty miles per hour; and, third, that there is a constant eastward movement of the upper strata of the atmosphere at a rate of perhaps seventy-five miles per hour—the situation becomes much simplified.

The periphery of the cyclonic mass on its northern side, moving as it does to the west, meets the air of the constant eastward current and backs or dams it up, thus producing

the high almost invariably observed on the northwestern quadrant. The air thrown or carried up through the funnel of the cyclone remains in this situation more than in any other part of the region corresponding to the circumference of the cyclone. For to the south at this high level the translatory and rotatory movements correspond to and in a large measure neutralize each other. To the west the current of the cyclonic mass is transverse and not counter to the constant overcurrent, and besides, the flow having just emerged from the great friction of the northern side, has had its mass deeply shorn when it leaves the northwestern quadrant. On the eastern aspect, the masses of air carried up and thrown out by the cyclone move onward even at a more rapid pace with the overcurrent and are carried out of the way, giving rise to the *cirrus* clouds usually seen under such circumstances. A high then must accumulate on the northwestern quadrant. As soon as the cyclone has passed any given point, the 'high' begins to flow out in obedience to the laws of equilibrium. To the east it is hindered by the snarly cyclone. To the north it is hindered by the conservation of areas due to the narrowing meridians and perhaps the undertow equatorward. To the southeastward, then, it must escape into the depression created by the passing cyclone.

The blizzard.—If this outflow of the high finds a lofty and long range of mountains running north and south, these will behave as one of the banks of a great river or one side of a river bed in causing the mass to take on a spiral form of movement. By this movement the atmosphere will be continuously climbing obliquely up the mountains on the western side, while on the eastern border of the spiral the cold dry air will be as continuously drawn down from the upper regions. The western blizzard is such a current, and the Texas norther its continuation.

The great majority of our cyclonic 'laws,' however, do not originate in the tropical north Atlantic, but in the tropical north Pacific. They arise over the innumerable islands found in that region, move west till deflected by the Asiatic mainland, carrying

rain and moisture to various distances inland, and then they veer around till, caught in the eastward overcurrent, they are carried eastward across the Pacific, the American continent and often across the Atlantic, and far into the eastern hemisphere again before being arrested.

This is not to deny that cyclones may be formed in other ways, though it may be hard to see how; but since cyclones without number are formed over tropical islands ready to start on their travels, how else can it be than that some of them are caught up in the way described and borne away on their earth-girdling journey?

D. T. SMITH.

SPECIAL ARTICLES.

A CONTRIBUTION TO THE HISTORY OF THE CONTROVERSY OF FLAMSTEED WITH NEWTON AND HALLEY.

THE library of the United States Military Academy at West Point owns a fine copy of Flamsteed's '*Historia Britannica Cœlestis*' (London, 1712) which is without any manuscript notes or corrections. To one of the fly leaves a single folio leaf was fastened: 'An estimate of the number of folio pages that the *Historia Britannica Cœlestis* may contain when printed,' which is dated 'The Observatory, Nov. 8, 1704.' On the blank side of this leaf is written, by Flamsteed himself, the words: 'Mr. Flamsteed's Estimate.' The printed folio page is set up in paragraphs, and Flamsteed has written comments opposite to many of them. As other copies of the '*Historia Britannica Cœlestis*' probably contain this folio estimate, I will copy here the MS. comments only, not the paragraphs to which they refer.

The first seven lines of paragraph 1 refer to Gascoigne's observations; they are enclosed by a MS. brace; Flamsteed's comment is:

These are not yet printed, being reserved to be inserted in the preface.

The last four lines of paragraph 1 refer to observations of eclipses, Jupiter's satellites, sun-spots, comets, etc., taken with a large sextant, etc., between the years 1675 and 1689 at Greenwich; they are enclosed by a MS. brace; the paper at the margin is torn here, but I make out Flamsteed's comment to be: